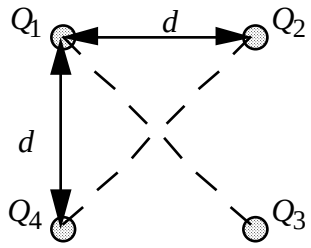
EC 2600 SAMPLE EXAM PROBLEMS

1. Given the vector $\vec{A} = 5\hat{x} - 3\hat{z}$ and $\vec{B} = \hat{x} + 2\hat{y} + \hat{z}$
(a) Find the angle between the two vectors.
(b) Find a vector perpendicular to the plane containing the two vectors.

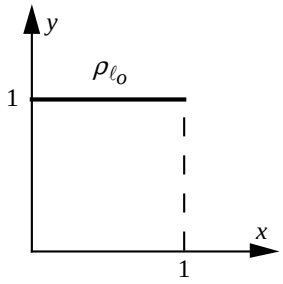
2. Four charges are placed at the corners of a square with sides of length d. What conditions must be satisfied so that there is no force on a charge at the center of the square?



3. Find the charge density in free space if the electric field is given by $\vec{E} = r\sin\phi\ \vec{r} + 2r\cos\phi\ \hat{\phi} + 2z^2\hat{z}$.

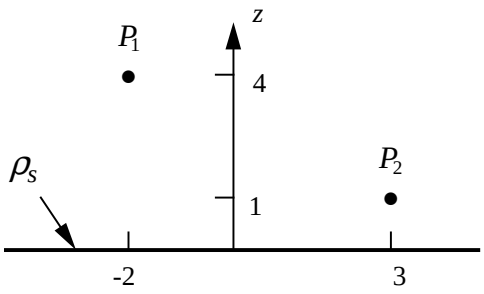
4. Express the vector $\vec{A} = 2y\hat{x} + z^2\ \hat{z}$ in cylindrical coordinates.

5. A uniform line charge of density ρ_{ℓ_o} C/m has a length L. It is oriented parallel to the x axis with one end on the y axis as shown. Find the potential at the origin by integrating over the charge distribution.

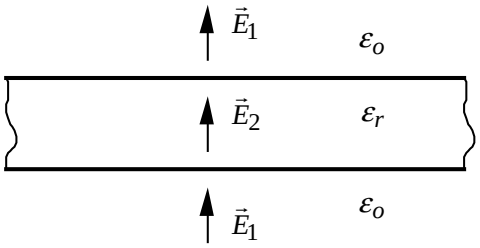


6. The potential in a region of space is given by $V = 5x^2 + 3y + z$. Find the electric field intensity in the region.

7. An infinite sheet of uniform (constant) surface charge ρ_s ($\mathrm{C/m^2}$) lies in the $z = 0$ plane.
(a) Write an expression for the electric field intensity as a function of distance (z) from the sheet.
(b) What is the potential difference between points 1 and 2?



8. A dielectric slab with relative permittivity ε_r is placed in an electric field $\vec{E}_1 = E_o\hat{z}$ V/m in free space so that the slab faces are perpendicular to the field. Find the electric field in the dielectric, $\vec{E}_2$.



9. Point charges are distributed on the z axis as shown below. Find the charge Q so that the electric field at $z = 0$ is zero.